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ABSTRACT

Two studies examined the effects of using ACT's Educational Plainning and Assessment System (EPAS) and benefits of using the EXPLORE and PLAN programs for students and schools in terms of achievement gains, educational planning, and educational preparation at grades 10, 11, and 12. Two data sets were used. The first consisted of 156,928 students who took PLAN as sophomores in 1999-2000, of whom 87,730 also tool EXPLORE in grade 8 in 1997-1998. The second consisted of 440,310 students who took the ACT Assessment as juniors in 1999-2000 or seniors in 2000-2001, of whom 189,371 also took PLAN in grade 10 in 1998-1999. Students participating in EXPLORE achieved PLAN Composite scores that were, on average, 0.31 PLAN Composite score units higher than were those of students not participating in EXPLORE, given all other variables studied. Moreover, students' odds of taking or planning to take rigorous mathematics and science courses, planning to take college preparatory curriculum, and planning to attend college were greater for those who participated in EXPLORE, compared to those who did not. Students participating in PLAN achieved ACT Composite scores that were, on average, 0.47 ACT Composite score units higher than were those of students not participating in PLAN, given all other variables studied. Moreover, students' odds of taking or planning to take rigorous mathematics and science courses and planning to take the college preparatory core curriculum were greater for those students who participated in PLAN, compared to those who did not. (Contains 4 tables, 10 figures, and 7 references.) (Author/SLD)

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The Effects of Using EPAS Programs on PLAN and ACT Assessment Performance

Julie Noble

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The Effects of Using EPAS Programs on PLAN and ACT Assessment Performance

Julie Noble

Abstract

Two studies examined the benefits of using the EXPLORE and PLAN programs for students and schools in terms of achievement gains, educational planning, and educational preparation at grades 10, 11 and 12. Two data sets were analyzed: The first consisted of 156,928 students who took PLAN as sophomores in 1999-2000, of which 87,740 also took EXPLORE in grade 8 in 1997-98. The second consisted of 440,310 students who took the ACT Assessment as juniors in 1999-2000 or seniors in 2000-2001, of which 189,371 also took PLAN in grade 10 in 1998-99.

Students participating in EXPLORE achieved PLAN Composite scores that were, on average, .31 PLAN Composite score units higher than were those of students not participating in EXPLORE, given all other variables studied. Moreover, students' odds of taking or planning to take rigorous mathematics and science courses, planning to take the college preparatory curriculum, and planning to attend college were greater for those who participated in EXPLORE, compared to those who did not.

Students participating in PLAN achieved ACT Composite scores that were, on average, .47 ACT Composite score units higher than were those of students not participating in PLAN, given all other variables studied. Moreover, students' odds of taking or planning to take rigorous mathematics and science courses and planning to take the college preparatory core curriculum were greater for those students who participated in PLAN, compared to those who did not.

The Effects of Using EPAS Programs on PLAN and ACT Assessment Performance

During the past 15 years there have been multiple federal efforts to improve the education of America's students, including the National Commission on Excellence in Education (National Commission on Excellence in Education, 1983), the National Education Summit and Goals 2000 (National Education Goals Panel, 1999), and the No Child Left Behind Act (U.S. Department of Education, 2002). Most recently, with the passage of the No Child Left Behind Act, schools are now required to show evidence of improvement in achievement for all students. Schools that are unable to demonstrate instructional quality and improvement in student achievement are threatened with potential mandated school reforms or closure (U.S. Department of Education, 2002). Thus, the educational community is being held accountable for student achievement and specifically for providing a return on the public's investment in education.

Two objectives of the No Child Left Behind Act are to improve the rigor of the high school curriculum and to provide students with equal access and opportunity intended to close racial/ethnic and gender achievement gaps (U.S. Department of Education, 2002). In a recent policy report, it was recommended that all students, as early as middle school, begin and complete a challenging college preparatory curriculum (Noeth and Wimberley, 2002). This recommendation is supported by ACT research, which has shown both that rigorous course work is related to academic achievement (e.g., Roberts and Noble, 2003; Noble and Powell, 1995) and that racial/ethnic and gender differences in PLAN and ACT Assessment scores are reduced when prior achievement, course work taken, educational needs, and educational plans were statistically controlled (Roberts and Noble, 2003; Schiel, Pommerich, and Noble, 1996).

Given the heightened federal pressure towards school reform, school administrators, counselors, and teachers have the difficult tasks of

1. Identifying and implementing ways to document the benefits of an education at their school for various stakeholders.
2. Identifying and implementing methods for increasing achievement for all students, especially for disadvantaged students.
3. Providing a mechanism to ensure that students are planning for and participating in a rigorous high school curriculum that will adequately prepare them for future education and work.

Moreover, especially given the current economic status in most states, schools are looking for ways to fulfill these tasks in cost-effective ways. Mechanisms that address multiple needs will be of great interest and benefit to schools and school districts.

ACT's Educational Planning and Assessment System® (EPAS) is intended to measure students' educational knowledge and skills at grades 8-9, 10, and 11-12 (http://www.act.org/epas/index.html). EXPLORE is typically administered to students in grade 8 or 9; PLAN is typically administered in grade 10. College-bound high school juniors and seniors take the ACT Assessment. EXPLORE is typically administered to all students in grade 8 or 9; PLAN is either administered to all students in grade 10 or to volunteer students, who typically take PLAN as practice for taking the ACT Assessment the following year. The ACT Assessment is typically taken by those students planning to attend college, though in Illinois and Colorado the ACT Assessment currently is administered to all 11th graders in the state, regardless of their educational plans after high school.

EPAS® was developed in response to the need for all students to be prepared for high school and the transitions they make after graduation. It provides a longitudinal, systematic approach to educational and career planning, assessment, instructional support, and evaluation.

The system focuses on the integrated, higher-order thinking skills students develop in grades K-12 that are important for success both during and after high school. EPAS is unique in that its programs can be mixed and matched in ways that meet the needs of individual schools, districts, or states.

Each program includes the four components that form the foundation of EPAS:

- Student Planning, where students can identify career and educational goals early and then pursue those goals.
- Instructional Support, where support materials and services help classroom teachers prepare their students for the coming transitions. This component reinforces the direct link between the content and skills measured in the EPAS programs and those that are taught in high school classrooms.
  - Assessment, where student achievement is assessed at three key transition points so that academic progress can be monitored to ensure that each student is prepared for postsecondary education or work.
  - Evaluation, where academic information monitoring provides teachers and administrators with a comprehensive analysis of academic growth between EPAS levels.

These four components of EPAS are intended to work together to respond to the needs of students, teachers, and school administrators.

Research on ACT's EPAS programs has supported their uses in assessing student achievement (e.g., Roberts and Noble, 2003; Schiel, Pommerich, and Noble, 1996). The purpose of this study is to examine the broader benefits of using the EXPLORE program at grade 8 for improving student outcomes at grade 10, and the benefits of using the PLAN program at grade 10 for improving students outcomes at grades 11 and 12.

Data

EXPLORE/PLAN Study

The data for this study were based on all students who participated in PLAN as sophomores in academic year 1999-2000 (N = 714,246). Of these students, 113,524 also participated in EXPLORE in grade 8 in 1997-98. For many EXPLORE-tested students, the specific middle school attended could not be identified; students are frequently identified by school district, rather than by individual school. High school attended (at grade 10) was therefore used as a covariate in adjusting for differences in characteristics of high schools attended by students who had previously participated in EXPLORE and high schools attended by students who had not previously taken EXPLORE.

Student-level data were matched with the Market Data Retrieval (MDR; Shelton, Connecticut) history to obtain information about the characteristics of the high schools that these students attended in grade 10. The school characteristic variables used for the study included accreditation region of the country, type (public/private), location (urban/suburban/rural), enrollment size per grade, and type of school district (multiple/single high school). All categorical school characteristic variables were dummy-coded for the analyses. In addition, the data were matched with the national 2000 ACT-tested graduating class history to obtain the average ACT Composite for each high school. These variables were used to control statistically for differences between high schools of students who had and had not previously participated in EXPLORE.

The EXPLORE and PLAN tests are curriculum-based. They measure students' skills and knowledge in English, mathematics, reading, and science. Scores range from 1 to 25 for EXPLORE and 1 to 32 for PLAN. EXPLORE and PLAN also report a Composite score, equal to

the rounded arithmetic average of the four subject area scores. PLAN Composite scores were used as a criterion variable for the study, to determine the benefit of using EXPLORE for improving student achievement at grade 10, as measured by PLAN.

The Student Information and Course Information Sections of the PLAN program collect information about students' educational plans, family background, and the course work they have taken or plan to take during high school. Students' course work taken and planned in mathematics and science, whether they were college-bound after high school, and their plans to take or not take the college preparatory curriculum (four years of English and three years each of mathematics, social studies, and science) were used as additional criterion variables in the study. Individual mathematics and science courses were studied, as well as particular combinations of course work (e.g., whether or not the student planned to take Algebra 1, Algebra 2, and Geometry). Course work in English and social studies was not included in the analyses because prior research has shown limited variability in students' course taking in these subjects (e.g., Roberts and Noble, 2003), as measured by the Course Information Section of PLAN. Students' race/ethnicity and gender were also included to determine whether improved outcomes differed by population subgroup. Racial/ethnic categories included African American, Caucasian American, Hispanic (Mexican American/Chicano and Puerto Rican, Cuban, Other Hispanic), Asian, and Other race (multiracial, American Indian, students of other racial/ethnic groups, and those who did not report their race).

The sample was limited to students who had valid PLAN Composite scores; had reported their race/ethnicity and gender, and had valid data for all student- and school-level variables used in the analyses. In addition, the sample was limited to only those schools that administered PLAN to all of their sophomores. This restriction was used so that the results would reflect the

benefits of EPAS for the more heterogeneous sample of all students, rather than only those who were college-bound.

The final sample consisted of 156,928 students who participated in PLAN as sophomores in 1999-2000 (3,224 schools). Of these students, 87,740 (2,434 high schools) also participated in EXPLORE in grade 8 in 1997-98.

In fall 2001 EXPLORE scores were rescaled to allow direct interpretations of EXPLORE scores relative to PLAN scores. EXPLORE scores are now interpreted as being "on a common scale" with PLAN scores: An EXPLORE score can be interpreted as the score grade 8 students would have received had they taken PLAN instead of EXPLORE. The EXPLORE scores for this study were converted to the new score scale to facilitate interpretation of the results.

PLAN/ACT Assessment Study

The data for this study were based on all students who took the ACT Assessment as juniors in 1999-2000 or as seniors in 2000-2001 (N = 1,069,772). Of these students, 360,700 also took PLAN in grade 10 in 1998-99. These data were matched with the MDR history to obtain information about the characteristics of the schools these students attended. The school characteristic variables used for the study included accrediting region of the country, type (public/private), location (urban/suburban/rural), and enrollment size per grade. Categorical characteristic variables were dummy-coded for the analyses. In addition, the data were matched with the national 2001 ACT-tested graduating class history to obtain the average ACT Composite for each high school. School-level information was used to control statistically for differences between students who did and did not take PLAN in grade 10.

The Needs Assessment section of the ACT Assessment collects information about students' reported needs for help with reading speed/comprehension, mathematics skills, study

skills, written expression, educational and occupational planning and personal concerns. Students' reported needs for help with mathematics, reading speed/comprehension, and study skills were included as independent variables to help control statistically for student-level differences.

The content of the PLAN and ACT tests is curriculum-based, and the tests assess students' skills and knowledge in English, mathematics, reading, and science. Scores range from 1 to 32 for PLAN and 1 to 36 for the ACT Assessment. The Composite score is the rounded arithmetic average of the four subject area scores. ACT Composite scores were used as a criterion variable for the study, to determine the benefit of using PLAN for improving student achievement at grades 11 and 12, as measured by the ACT Assessment.

The Student Profile and Course Grade Information Sections of the ACT Assessment collect information about students' educational plans, family background, and the course work they have taken or plan to take during high school. Students' course work taken and planned in mathematics and science and their plans to take or not take the college preparatory curriculum (four years of English and three years each of mathematics, social studies, and science) were used as additional criterion variables in the study. Individual mathematics and science courses were studied, as well as particular combinations of course work (e.g., whether or not the student planned to take Algebra 1, Algebra 2, and Geometry). Course work in English and social studies was not included in the analyses because prior research has shown limited variability in students' course taking in these subjects (e.g., Schiel et al., 1996), as measured by the Course Grade Information Section of the ACT Assessment. Students' race/ethnicity and gender were also included to determine whether improved outcomes differed by population subgroup. Racial/ethnic categories included African American, Caucasian American, Hispanic (Mexican

American/Chicano and Puerto Rican, Cuban, Other Hispanic), Asian, and Other race (multiracial, American Indian, students of other racial/ethnic groups, and those who did not report their race).

The sample was limited to students who had valid ACT Composite scores; had reported their race/ethnicity, gender, and had valid data for all student- and school-level variables used in the analyses. In addition, the sample was limited to students from schools that had a minimum of 25 ACT-tested students. For this sample, students taking PLAN as volunteers or in an all-sophomore-testing situation were included in the study.

The final sample consisted of 440,310 students who took the ACT Assessment as juniors in 1999-2000 or as seniors in 2000-2001 (14,201 schools). Of these students, 189,371 (3,671 schools) also took PLAN in grade 10 in 1998-99.

Method

The following describes the methods used to analyze the data for both studies. For simplification, the description focuses on the EXPLORE/PLAN study, but the approaches used also apply to the PLAN/ACT study.

PLAN score means, standard deviations, and sample sizes were calculated for students who did and did not participated in EXPLORE in grade 8. For those students who participated in EXPLORE, similar statistics were calculated for EXPLORE scores. In addition, means and percentage distributions were calculated for all relevant student and school characteristics used in the analyses.

Regression Analyses

A linear regression model was used to predict PLAN Composite scores from an indicator of whether students had participated in EXPLORE in grade 8. Student and school characteristic

variables were also included in the model to control statistically for differences in the two groups of students. School characteristic variables that were not statistically significant ($p < .001$) were dropped from the model. The results were evaluated in terms of the average increase in PLAN Composite score associated with participation in EXPLORE.

Using the same predictor variables as in the model above, logistic regression models were developed for predicting mathematics and science course work planned, plans to take the college- preparatory core curriculum, and plans to attend college. The results were evaluated in terms of the proportional increase in the odds of a particular outcome that is associated with participating in EXPLORE (odds ratio). The odds ratio is the ratio of the odds for the two groups defined by their participation in EXPLORE:

$$odds\ ratio = \frac{p(1)/[1 - p(1)]}{p(0)/[1 - p(0)]} = e^{\beta}$$

where $p(0)$ = probability of outcome for group not participating in EXPLORE (0)

$p(1)$ = probability of outcome for group participating in EXPLORE (1)

β = the regression coefficient associated with participating in EXPLORE

The same set of predictors was used to develop separate linear and logistic regression models for gender and racial/ethnic groups. Due to the smaller sample sizes within groups, a less conservative level of statistical significance was used ($p < .01$).

Results

EXPLORE/PLAN Study

Descriptive statistics for students participating and not participating in EXPLORE and their respective high schools are provided in Table 1. The top portion of the table includes student-level statistics for EXPLORE and PLAN Composite scores, gender, race/ethnicity, core course work, and college plans. The bottom portion of the table includes high school-level statistics for region, type, locale, school district type, and average ACT Composite.

TABLE 1

Descriptive Statistics for Students and High Schools by Students' Participation in EXPLORE

Statistic	Students' previous participation in EXPLORE	
	Participated	Did not participate
Student characteristics		
Avg. EXPLORE Composite (SD)	15.8 (3.38)	--
Avg. PLAN Composite (SD)	17.9 (3.76)	18.0 (3.75)
Pct. female	47	48
Pct. African American	9	9
Caucasian American	75	75
Hispanic	6	7
Asian American	2	3
Other	7	7
Pct. taking core curriculum	75	72
Pct. college-bound	82	83
Number of students	87,740	156,928
High school characteristics		
Pct. Mid Atlantic region	3	7
New England region	1	2
North Central region	73	56
Pacific Northwest region	2	7
Southern region	19	22
West Coast region	2	6
Pct. public	86	62
Pct. Rural	48	55
Suburban	29	21
Urban	22	24
Pct. multi-school district	42	41
Avg. ACT Composite (SD)	20.9 (1.95)	21.3 (2.04)
Number of high schools	2,434	3,224

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As shown in Table 1, students did not differ substantially, according to whether they previously participated in EXPLORE. However, the high schools in which they later enrolled differed by region and type. Schools with students who had previously participated in EXPLORE were more likely to be public schools, and were more likely to be from the North Central region of the country, than were those with students who had not previously participated in EXPLORE.

Table 2 contains the linear and logistic regression coefficients associated with the school characteristics used in the final linear and logistic models for all students. For the linear model, the regression coefficient for each predictor variable reflects the average increase in PLAN Composite score associated with a one-unit increase in that variable, given all other variables in the model (i.e., PLAN Composite = $\alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k$). For the logistic models, the regression coefficient for each predictor variable represents the increase in the logit of each dichotomous criterion variable that is associated with a one-unit increase in the predictor variable, given all other variables in the models:

$$\text{where logit}(p[Y=1]) = \ln\left[\frac{p}{1-p}\right] = \alpha + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k,$$

p = probability of outcome

x = predictor variable

The criterion variables for the logistic models are listed in the first column of the table, following PLAN Composite The last column of the table contains the percentage increase in the odds of the occurrence of a given criterion variable (e.g., planning to go to college) by participating in EXPLORE, given all other variables in the model.

TABLE 2

Linear and Logistic Regression Coefficients Associated With Selected School Characteristic Variables – Final EXPLORE/PLAN Model

Criterion	Region						Location					
	Mid-Atl. vs. all	New Engl. vs. all	North Cent. vs. all	Pac. NW vs. all	South. vs. all	Public vs. private	Rural vs. urban	Sub. vs. urban	Mult. vs. single sch. dist.	Avg. ACT Comp.	Participated in/did not participate in EXPLORE	Pct. increase in odds of outcome by participating in EXPLORE
Linear regression												
PLAN Composite	.04	-.27	.17	.09	.28	-.93	.06	.19	.12	.66	.31	
Logistic regression												
Taken/planned												
Core/noncore	.29	.16	-.17	-.45	.21	-.31	-.17	-.15	.06	.06	.28	33
Algebra 2	-.17	.18*	-.29	-.21	.43	.01*	-.35	-.19	.30	.08	.47	59
Geometry	-.19	.61	-.25	-.26	.47	-1.38	-.54	-.07*	.57	.03	.45	58
Trigonometry	.58	-.03*	-.14	.25	-.60	-.42	-.40	-.11	.21	.04	.18	20
Calculus	-.01*	.21	-.24	.13	-.08	-.04*	-.32	-.04*	.29	.05	.00*	0
Alg. 1, Alg. 2, & Geometry	-.30	.10*	-.12	-.26	.50	-.21	-.24	-.13	.23	.10	.43	54
Alg. 1, Alg. 2, Geom., & Trig.	.36	-.03*	-.09	.15	-.41	-.27	-.31	-.09	.17	.06	.23	25
Biology	.44*	1.69	-.61	-1.03	.94	-2.07	-.31	.04*	-.07*	-.03*	.43	53
Chemistry	.36	.36	-.22	-.38	.34	-.93	-.54	-.27	.19	.03	.28	32
Physics	.19	.48	-.21	-.27	.02*	-.36	-.40	-.14	.17	.04	.14	16
Gen. Sci., Biol., & Chem	.42	.19	-.14	-.21	.08	.11	-.04*	-.04*	-.01*	-.01*	.17	19
Biol., Chem., & Physics	.32	.32	-.17	-.22	.00*	-.02*	-.20	-.07	.06	.02	.13	14
College-bound/ non-college-bound	.02*	-.06*	-.03*	-.18	.15	-.59	-.23	-.01*	.16	.11	.17	18

* Not statistically significant ($p < .001$)

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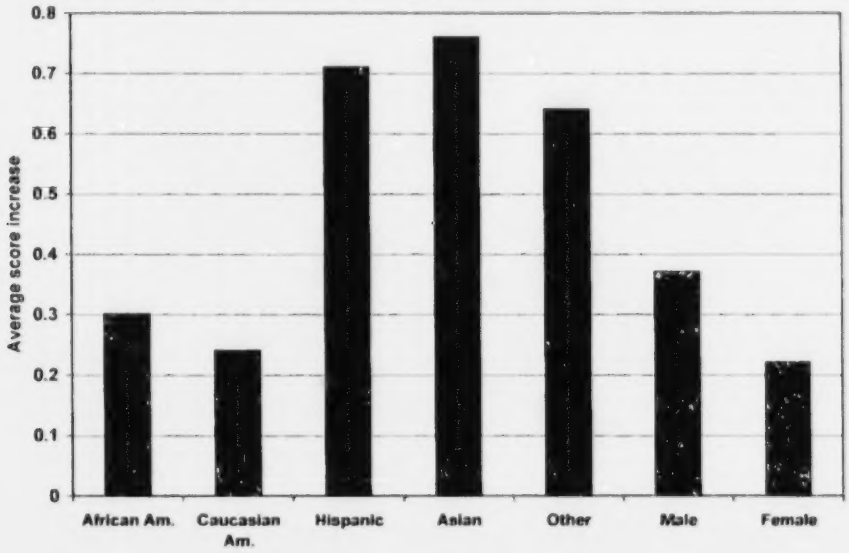
For all criterion variables except planning to take Calculus, participating in EXPLORE was positively and statistically significantly ($p < .001$) associated with all criterion variables, when school characteristics were statistically controlled. Students participating in EXPLORE achieved PLAN Composite scores that were, on average, .31 PLAN Composite score units higher than were those of students not participating in EXPLORE, given all other variables in the model. Moreover, participating in EXPLORE was associated with an increase of over 50% in the odds of students planning to take Algebra 2, Geometry, or Biology, or a combination of Algebra 1, Algebra 2, and Geometry, compared to those not participating in EXPLORE. Increases in odds of over 30% were also found for taking the core curriculum and for planning to take Chemistry, given all other variables in the models.

Race and Gender Results. Using the predictor variables identified for the total group, models were also developed for racial/ethnic and gender groups. Due to insufficient variability in selected criterion variables for some groups, all possible criterion variable/group combinations could not be developed for Geometry and Biology. Only those results where all possible criterion variable/group combinations could be analyzed, and those that differed across groups, are reported here. The increase in odds associated with participating in EXPLORE was statistically significant ($p < .01$) unless otherwise specified. The results are shown in Figures 1 through 6.

Figure 1 illustrates the results of the linear regression models for predicting PLAN Composite score by race/ethnicity and gender. The bars in the graph show the regression coefficient for each group associated with participating in EXPLORE, i.e., the average increase in PLAN Composite score associated with participating in EXPLORE, given all the other variables in the model. The greatest average score increases occurred for Hispanic, Asian, and

Other race students, with values exceeding .65 PLAN Composite score units. The smallest average score increases occurred for Caucasian American and female students.

FIGURE 1. **Average Increase in PLAN Composite Score Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**



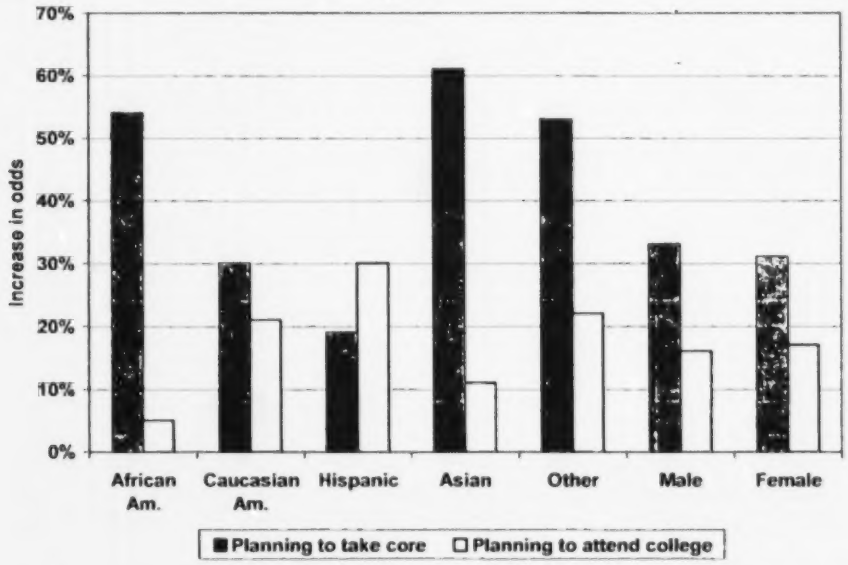
Figures 2 through 6 summarize the results of the logistic regression analyses. Each chart shows the increase in the odds of a specific outcome associated with participation in EXPLORE, given all of the school characteristic variables in the model.

Figure 2 shows that the increase in odds of students taking or planning to take the college preparatory curriculum by using EXPLORE was greatest for African American, Asian, and Other race students, with increases in odds exceeding 50% for all three groups. The increases in odds for males and females were similar, with increases in odds of 33% and 31%, respectively.

Figure 2 also shows increases in the odds of students planning to attend college associated with participation in EXPLORE across racial/ethnic and gender groups. The largest increases were found for Hispanic, Other race, and Caucasian American students, with increases in odds exceeding 20%. The smallest increases occurred for African American students (increase

in odds = 5%; $p > .01$) and Asian students (increase in odds = 12%; $p > .01$). A relatively large percentage of African American (84%) and Asian (90%) students in this sample planned to go to college, regardless of whether or not they participated in EXPLORE.

FIGURE 2. **Increase in Odds of Taking or Planning to Take Core, and Planning to Attend College Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**



Participating in EXPLORE was also associated with increases in the odds of students taking or planning to take Algebra 2 for all racial/ethnic and gender groups, given all other variables used in the model (see Figure 3). Increases in odds for African American, Asian, and Other race students exceeded 90%; with other groups showing increases in the 40% to 60% range. Females had a slightly larger increase in odds than did males (62% vs. 55%).

When examined across a sequence of mathematics courses (taking or planning to take Algebra 1, Algebra 2, and Geometry), the results were similar to those for Algebra 1 for all groups except African American students (see Figure 4), but with somewhat smaller increases in odds for all groups. Further examination revealed that while 94% and 96%, respectively, of all African

American students in the study planned to take *either* Algebra 2 or Geometry, 84% planned to take *both* courses, as well as Algebra 1.

FIGURE 3. **Increase in Odds of Taking or Planning to Take Algebra 2 Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**

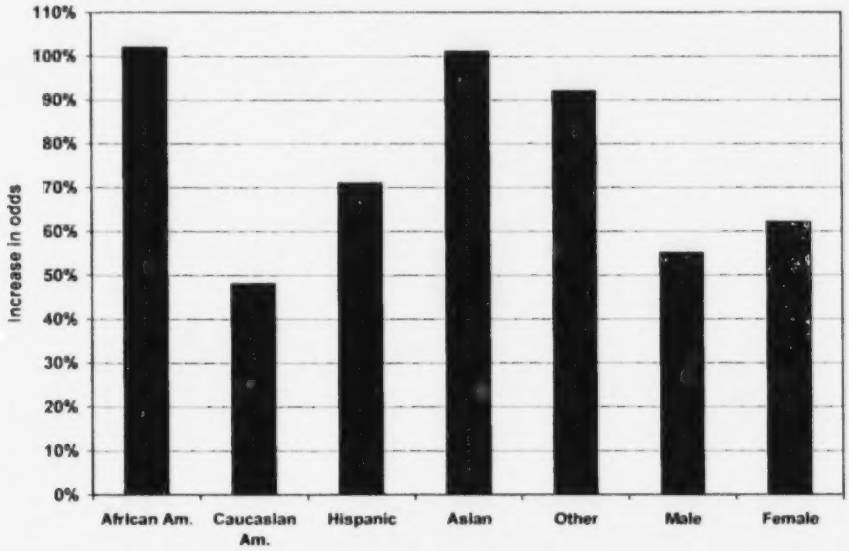


FIGURE 4. **Increase in Odds of Taking or Planning to Take Algebra 1, Algebra 2, and Geometry Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**

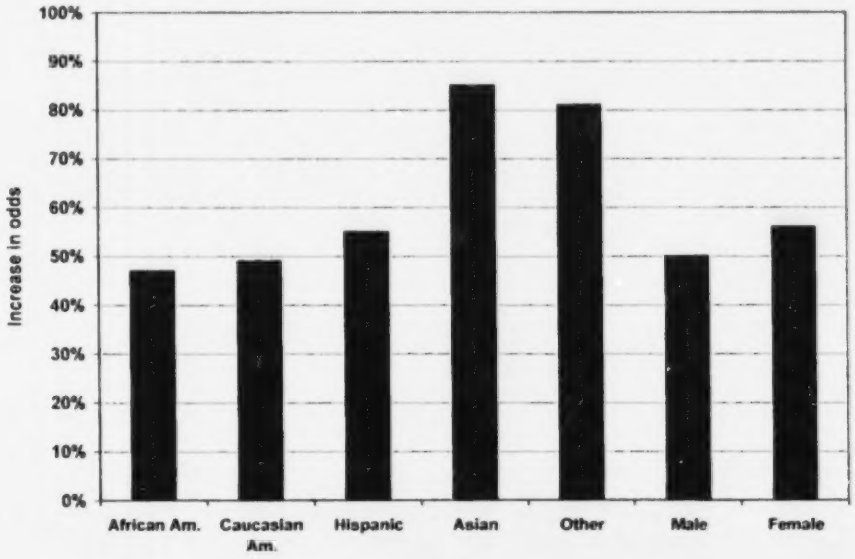
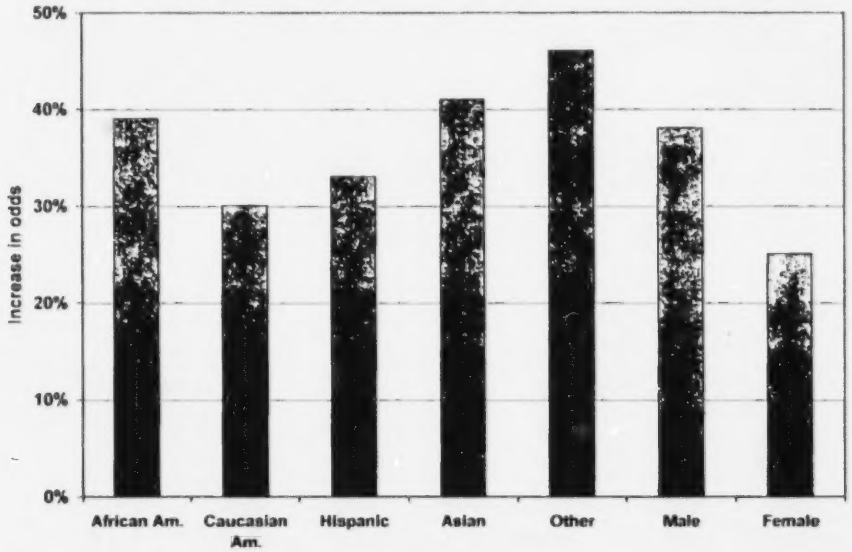


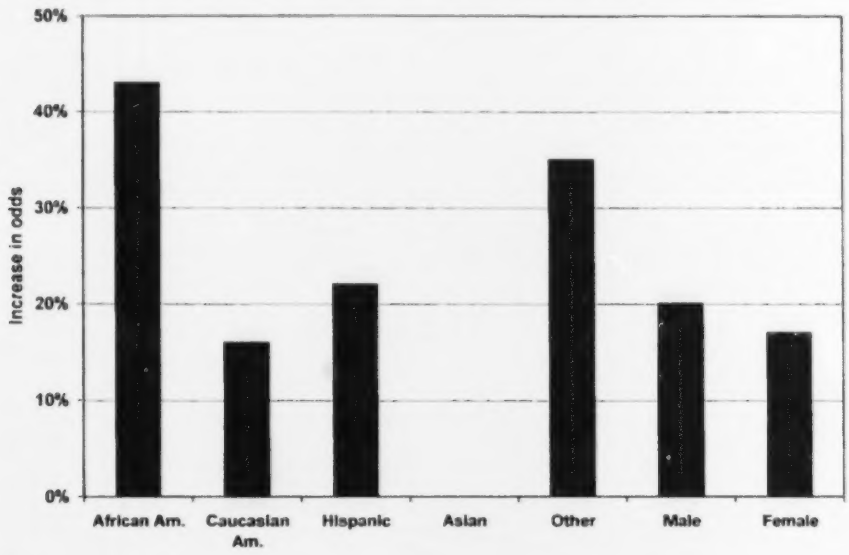
Figure 5 contains the results for taking or planning to take Chemistry. African American, Asian, and Other race students again had the greatest increases in odds associated with participation in EXPLORE, with increases in odds exceeding 35%. The increases in odds for Caucasian American and Hispanic students were slightly lower, with values of 30% and 34%, respectively. The increase in odds for males was 38%, compared to 25% for females.

FIGURE 5. **Increase in Odds of Taking or Planning to Take Chemistry Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**



In Figure 6, participating in EXPLORE was associated with an increase in the odds of African American and Other race students taking or planning to take General Science, Biology, and Chemistry, compared to students not participating in EXPLORE. For Asian students, participating in EXPLORE showed no benefit for increasing the odds of these students taking or planning to take these courses ($p > .01$). Over 70% of all Asian students in the study took or planned to take these courses, regardless of whether they participated in EXPLORE or not.

FIGURE 6. **Increase in Odds of taking or Planning to Take General Science, Biology, and Chemistry Associated With Participation in EXPLORE, by Race/Ethnicity and Gender**



PLAN/ACT Assessment Study

Descriptive statistics for students and schools using and not using PLAN are provided in Table 3. The top portion of the table includes student-level statistics for PLAN and ACT Composite scores, gender, race/ethnicity, core course work, high school average (HS GPA), and needs for help with mathematics skills and reading speed/comprehension. The bottom portion of the table includes school-level statistics for per grade enrollment, type, locale, and average ACT Composite. The variables reported in the table were those used in the final models of the study.

As shown in Table 3, students from schools using PLAN had somewhat higher ACT Assessment scores and were more likely to be Caucasian American than were students from schools not using PLAN. Moreover, schools using and not using PLAN differed by enrollment size, average ACT Composite, and school type. Schools using PLAN were less likely to be public schools and had somewhat higher per grade enrollments than did those schools not using PLAN.

TABLE 3

Descriptive Statistics for Students and High Schools by PLAN Participation

Statistic	Participated in PLAN	Did not participate in PLAN
Student characteristics		
Avg. PLAN Composite (SD)	19.9 (3.60)	--
Avg. ACT Composite (SD)	22.4 (4.65)	21.1 (4.67)
Pct. female	59	60
Pct. African American	7	12
Caucasian American	80	71
Hispanic	4	7
Asian American	3	4
Other	6	7
Pct. taking core curriculum	74	70
Pct. needing help with math skills	31	26
Pct. needing help with reading speed/comprehension	38	40
HS GPA (SD)	3.31 (.56)	3.25 (.57)
Number of students	189,371	440,310
High school characteristics		
Per grade enrollment (SD)	320.9 (243.1)	288.6 (266.5)
Pct. public	85	90
Pct. Rural	43	46
Suburban	33	30
Urban	24	23
Number of schools	3,671	14,201

Table 4 contains the linear and logistic regression coefficients associated with the student and school characteristics used in the final linear and logistic models for all students. For the logistic regression models, average ACT Composite score was either not statistically significant ($p < .001$) or was collinear with other independent variables, and was therefore not included in these models. The criterion variables for the logistic models are listed in the first column of the table, following ACT Composite. The last column of the table contains the percentage increase in the odds of the occurrence of a given criterion variable (e.g., planning to go to college) for students participating in PLAN, given all other variables in the model.

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TABLE 4

Linear and Logistic Regression Coefficients Associated with Selected Student and School Characteristic Variables – Final PLAN/ACT Model

Criterion	Per grade enr.	Public vs. private	Location: Rural vs. urban	Location: Sub. vs. urban	Need help with: Math	Need help with: Read. speed/ comp.	HS GPA	Avg. ACT Comp.	Taken/not taken PLAN	Pct. increase in odds of outcome by participating in PLAN
Linear regression										
ACT Composite	.01	-.14	-.39	-.06	-1.54	-1.09	3.88	.74	.47	
Logistic regression										
Taken/planned										
Core/noncore	.02	-.22	-.36	-.10	-.00*	-.21	.96	--	.11	11
Algebra 2	.04	-.51	-.21	-.00*	.04*	-.61	1.42	--	.35	42
Geometry	.09	-.63	-.74	-.38	-.03*	-.56	1.10	--	.34	40
Trigonometry	.01	-.42	-.36	-.00*	.15	-.59	1.17	--	.18	20
Calculus	.02	-.09	-.40	-.09	.24	-.81	1.76	--	.06	6
Other math beyond algebra 1	.02	-.30	-.27	-.01*	.10	-.42	.90	--	.11	11
Alg. 1, Alg. 2, & Geometry	.04	-.33	-.25	-.10	.03*	-.40	1.07	--	.24	28
Alg. 1, Alg. 2, Geom., & Trig.	.01	-.39	-.27	.04	.14	-.56	1.16	--	.17	19
Biology	-.02	-.137	-.34	-.09*	-.11	.14	.52	--	.15	16
Chemistry	.01	-.66	-.65	-.24	-.01*	-.37	1.19	--	.16	17
Physics	.04	-.52	-.49	-.14	.11	-.49	1.02	--	.06	6
Gen. Sci., Biol., & Chem	-.03	.13	-.08	-.02*	.01*	.01*	.39	--	.04	4
Biol., Chem., & Physics	-.01	-.16	-.26	-.07	.10	-.30	.82	--	.03	4

* Not statistically significant ($p < .001$)

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As stated earlier, for the linear model, the regression coefficient for each predictor variable reflects the average increase in ACT Composite score associated with a one-unit increase in that variable, given all other variables in the model. For the logistic models, the regression coefficient for each predictor variable represents the increase in the logit of each dichotomous criterion variable that is associated with a one-unit increase in the predictor variable, given all other variables in the models.

For all criterion variables, participating in PLAN was positively and statistically significantly ($p < .001$) associated with all criterion variables, when student and school characteristics were statistically controlled. Students participating in PLAN achieved ACT Composite scores that were, on average, .47 ACT Composite score units higher than were those of students not participating in PLAN, given all other variables in the model. Moreover, participating in PLAN corresponded to an increase of about 40% in the odds of students taking or planning to take Algebra 2 or Geometry, compared to those not participating in PLAN. Increases in odds of 15% to 30% were found for taking the core curriculum; taking or planning to take trigonometry; taking or planning to take Algebra 1, Algebra 2, and Geometry or Algebra 1, Algebra 2, Geometry, and Trigonometry; and taking or planning to take either Biology or Chemistry, given all other variables in the models.

Race and Gender Results. Using the predictor variables identified for the total group, models were also developed by race/ethnicity and gender. Only those results that differed across groups are reported here. The increase in odds associated with participating in PLAN was statistically significant ($p < .01$) unless otherwise specified. The results are shown in Figures 7 through 10.

Figure 7 illustrates the results of the linear regression models for predicting ACT Composite score by race/ethnicity and gender. The bars in the graph show the regression coefficient for each group associated with participating in PLAN, i.e., the average increase in ACT Composite score associated with participating in PLAN, given all the other variables in the model. The greatest average score increases occurred for African American, Asian, and male students, with values exceeding .50 ACT Composite score units. Smaller average score increases occurred for Caucasian American, Hispanic, and female students.

FIGURE 7. **Average Increase in ACT Composite Score Associated With Participating in PLAN, by Race/Ethnicity and Gender**

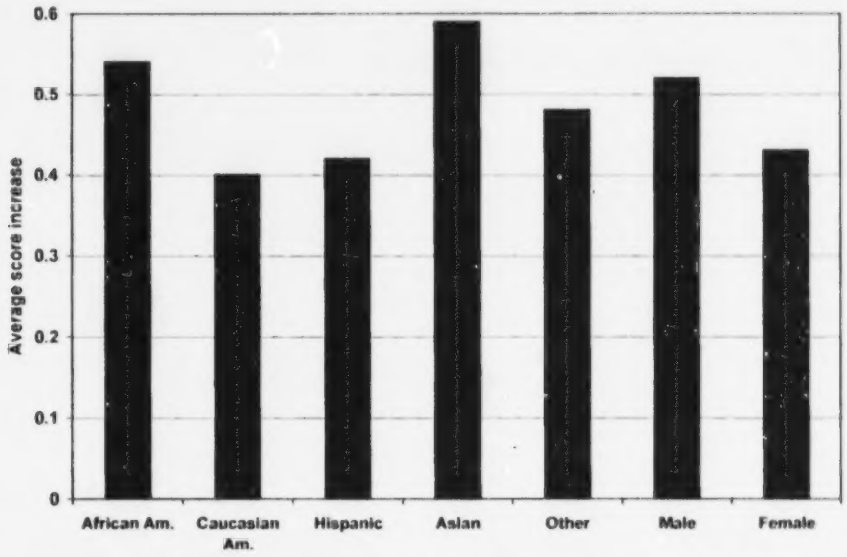
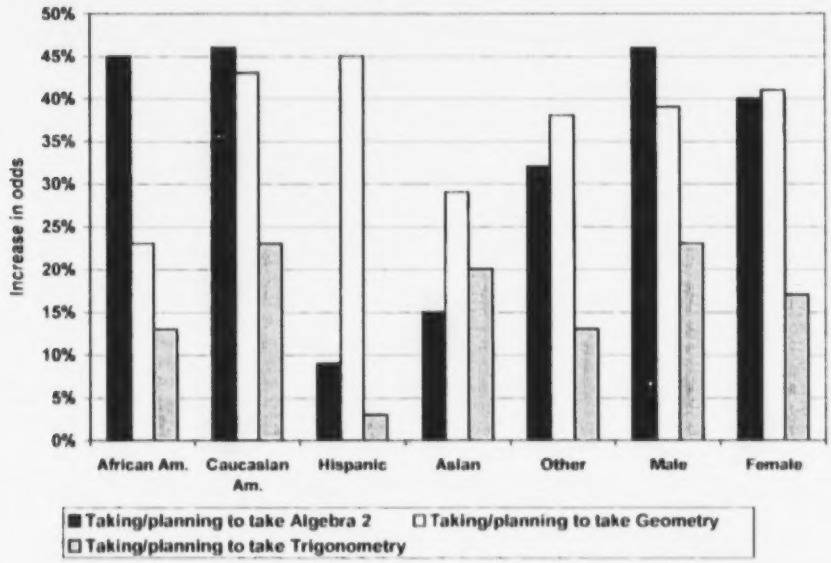


Figure 8 shows the increases in odds of students taking or planning to take Algebra 2, Geometry, or Trigonometry by using PLAN. For Algebra 2, the greatest increases were found for African American, Caucasian American and male students, with increases in odds of 45% or more. For Geometry, increases in odds of over 40% were found for Hispanic, Caucasian American and female students. Males and Other race students had slightly lower increases in odds. For all subgroups, the increases in odds of taking or planning to take trigonometry were lower than those for Algebra 2 and Geometry. Increases in odds for Caucasian American, Asian,

and male students were in the range of 20 to 25%. The increase in odds of Hispanic students taking or planning to take trigonometry was the smallest, at 3%.

FIGURE 8. **Increase in Odds of Taking or Planning to Take Algebra 2, Geometry, or Trigonometry Associated With Participating in PLAN, by Race/Ethnicity and Gender**



In comparison, Figure 9 summarizes the increases in odds of students taking or planning to take Algebra 1, Algebra 2, and Geometry. The greatest increase in odds was found for African American students (38%); gender groups did not differ. The smallest increase occurred for Asian students (3%).

The increases in odds of students taking or planning to take Biology or Chemistry by race/ethnicity or gender are shown in Figure 10. For both subjects, Asian students had the greatest increase in odds (62% and 36%, respectively). In comparison, increases in odds of 20% or more were found for Hispanic and female students taking or planning to take Biology, and for African American, Caucasian American, and male students taking or planning to take Chemistry.

FIGURE 9. **Increase in Odds of Taking or Planning to Take Algebra 1, Algebra 2, and Geometry Associated with Participating in PLAN, by Race/Ethnicity and Gender**

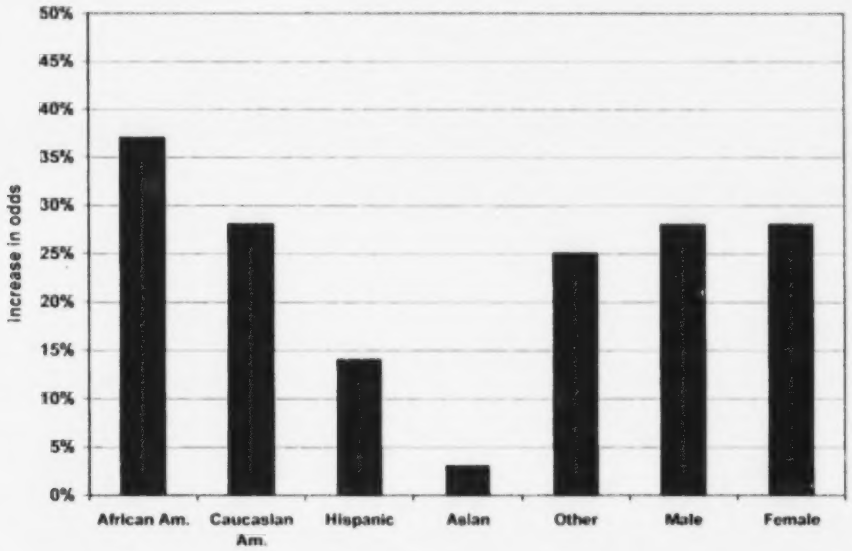
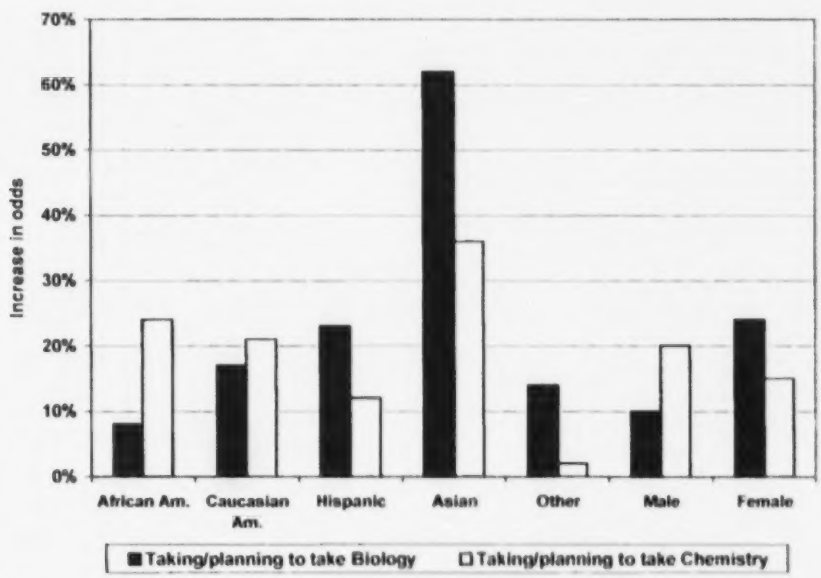


FIGURE 10. **Increase in Odds of Taking or Planning to Take Biology or Chemistry Associated with Participating in PLAN, by Race/Ethnicity and Gender**



Discussion

Ideally, to study the effects of using EPAS programs, students or schools would be randomly assigned to groups participating or not participating in these programs. Unfortunately, this type of lengthy experimental design is not feasible in an applied school setting. Instead, this study *statistically controlled* for several important characteristics of students participating in EXPLORE and PLAN and the high schools they attended. However, for the EXPLORE/PLAN study, high school characteristics of students who had and had not previously participated in EXPLORE were statistically controlled, rather than the middle school characteristics of schools that actually used EXPLORE. Moreover, this study did not control for the extent to which schools used these programs for student planning, instructional support, assessment, and evaluation. Future research will help to identify the relative benefits of different levels of implementation of EPAS for students and schools.

Given the preceding, the results of this study did show that participating in the EXPLORE program at grade 8 in conjunction with the PLAN program at grade 10, or participating in the PLAN program at grade 10 with the ACT Assessment program at grade 11-12, resulted in greater achievement gains, and in increased odds of students' planning to take rigorous mathematics and science courses, planning to take the college preparatory core curriculum, and planning to attend college, compared to not participating in these programs. In many cases, large benefits were found for African American and Hispanic students, compared to other racial/ethnic groups, as well as for females taking Biology and Geometry, compared to males.

With the pressure now on schools and districts to demonstrate their effectiveness, and to reduce gaps in achievement among population subgroups, the broad-spectrum program provided by EPAS would appear to be a useful solution. Not only did students show gains in PLAN and

ACT test scores that were associated with participating in the EPAS program, they were more likely to take or plan to take rigorous mathematics and science course work and plan to take the college preparatory core curriculum. In comparison, students' reported needs for additional help decreased over time.

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